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THE SOLITARY BEE *MELISSODES THELYPODII THELYPODII* COCKERELL (HYMENOPTERA: ANTHOPHORIDAE) COLLECTS POLLEN FROM WIND-POLLINATED *AMARANTHUS PALMERI* WATSON

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Abstract.—The native solitary bee *Melissodes thelypodii thelypodii* Cockerell was observed to harvest pollen from panicles of the anemophilous plant *Amaranthus palmeri* Watson in southeastern Arizona. Pure *Amaranthus* pollen loads were removed by females foraging at this plant, suggesting floral fidelity and this bee's potential value for commercial pollination of the related grain amaranths.

Key Words.—Insecta, pollination, anemophily, *Melissodes, Amaranthus,* pollen-foraging, bees

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Foragers of social bees will sometimes collect pollen from flowering plants that rely upon wind to transport pollen to receptive pistils (Faegri & van der Pijl 1978). Honey bees (*Apis mellifera* L.) and sometimes stingless bees (*Trigona* s.l.) collect pollen from diverse anemophilous (wind-pollinated) plants (Sharma 1970; O'Neal & Waller 1984; C. D. Michener, unpublished data). Less commonly, bumble bees (*Bombus* sp.) may collect pollen from anemophilous plants, such as bahia grass, *Paspalum notatum* var. *saurae* Parodi (JHC, unpublished data).

In contrast, nonsocial or solitary bees have rarely been reported to gather pollen from anemophilous plants. The pollen of oaks (*Quercus*), which are considered anemophilous, may be gathered by solitary bees when their preferred pollen hosts are not available (*Andrena erythronii* Robertson [Michener & Rettenmeyer 1956]; *Osmia rufa* [Raw 1974]; *Habropoda laboriosa* (Fabr.) [Cane & Payne 1988]). Several British *Andrena* reportedly collect pollen periodically from several anemophilous trees, such as oak and chestnut (Chambers 1945). Nomiine bees of the Old World genus *Rhopalomelissa* collect and may depend on grass pollen for larval provisions (C. D. Michener, unpublished data). The sweat bee *Dialictus illinoiensis* (Robertson) avidly harvests pollen from dallis grass, *Paspalum dilatatum* Poiret, augmenting the seed set of this grass (Adams et al. 1981).

Careless-weed (*Amaranthus palmeri* Watson) is a weedy, dioecious amaranth occurring through much of the central and western United States and Mexico (Munz 1959). The species exhibits several characteristics that typify anemophilous plants. It produces copious pollen that bears little of the oily pollenkitt typical of pollen usually collected by bees. Its small (24–26 μm diam) periporate "chenoam" (Chenopodiaceae–Amaranthaceae) type pollen grains are commonly implicated in human hayfever allergies (Wodehouse 1971). Bees have not been reported to visit this anemophilous plant.

We observed female *Melissodes thelypodii thelypodii* Cockerell working the spike-like panicles of male plants of *A. palmeri* for pollen during mornings of August, 1990, along the edge of a cotton field in the San Simon Valley of southeastern Arizona (Cochise Co.). In this vicinity, we previously noted this bee species sonicating flowers of *Solanum elaeagnifolium* Cavanilles and *S. rostratum* Dunal (Solanaceae) for pollen. Bees of other species that worked nearby *Solanum* flowers were never seen at *Amaranthus* (*Protoxaea gloriosa* (Fox), *Protandrena mexicanorum* (Cockerell), *Bombus sonorus* Say, and *Caupolicana yarrowi* (Cresson)).

The first female *M. thelypodii thelypodii* to visit a given inflorescence frequently released a visible cloud of pollen upon alighting. Females walked along the spikes gathering pollen, proceeding distally from mid-base along those spikes that were upright. They would then fly to a neighboring spike to continue collecting pollen. Some females accumulated a full load of *Amaranthus* pollen from five to seven spikes in as few as six minutes. A microscopic survey of the taxonomic constitution of their pollen loads revealed good floral fidelity. Pure loads of *Amaranthus* pollen were carried by five of six females collected at *Amaranthus*. The remaining female bore 11% cotton pollen and 89% *Amaranthus* pollen. We have found only one other reference to species of *Melissodes* gathering pollen from anemophilous plants. Adams et al. (1981) reported *M. bimaculata* (Lepeletier) to occasionally collect pollen from dallis grass.

The role, if any, of bees in the pollination of dioecious anemophilous plants has been debated in the pollination literature. Usually, solitary or social bees that harvest anemophilous pollen are considered mere pollen thieves, removing pollen from male plants but never subsequently visiting the nectarless female plants. Their contribution to pollination can not be discounted, however. Foragers may mistakenly visit female flowers upon occasion. Even if they only visit male flowers, wing and leg movements during pollen collection may dislodge prodigious quantities of pollen which, once airborne, can travel to female flowers.

The relative contributions of wind and insects, specifically bees, to the pollination of wild and cultivated amaranths also remains equivocal. Several weedy species have been implicated in human respiratory allergies, including *A. palmeri* (Wodehouse 1971). Unlike many anemophilous pollens, such as conifer pollen, the pollen of *A. palmeri* seems to be moderately nutritious for bees, containing 3.5% nitrogen, or 18.38% crude protein by micro-Kjeldahl analysis (SLB, unpublished data). Bee activity varies greatly at amaranths. Kaufman (1979) reported an absence of bees at cultivated grain amaranth. In contrast, Singh (1961) sometimes observed abundant bees at grain amaranth in India, and O'Neal & Waller (1984) found *Amaranthus* pollen to constitute 6% of the average annual pollen intake of honey bee colonies in the Sonoran desert, near Tucson, Arizona. Using pollen traps on honey bee colonies, one of us (SLB) found that cheno-am pollen constituted from 2–8% of the annual colony pollen harvest near Tucson during the years 1981–1989. The solitary bee *Hylaeus bisinuatus* Forster has been recorded visiting members of the Amaranthaceae (Krombein et al. 1979). We conclude that amaranth pollen is not a mere scopal contaminant in these cases. Bees will actively collect amaranth pollen, perhaps reflecting the ease with which quantities of this pollen can be harvested relative to other competing floral species.

For *Amaranthus retroflexus* L., Murphy (1978) demonstrated that insects alone could provide cross-pollination. Further, Hauptli & Jain (1985) found wide dis-

parities in outcrossing rates for their field experiments with cultivated *Amaranthus cruentus*. They attributed this result to variable densities of pollen-foraging honey bees in their plots.

Our observations demonstrate that females of the solitary bee *M. t. thelypodii* avidly visit staminate flowers of amaranth for pollen, exhibiting good species fidelity on a given foraging trip. For at least hermaphroditic species of commercial amaranth, the visitations of pollen-foraging bees have promise to improve outcrossing rates for the enhancement of genetic variation and perhaps even seed set of desirable cultivars.

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Literature Cited

Adams, D. E., W. E. Perkins & J. R. Estes. 1981. Pollination systems in *Paspalum dilatatum* Poir. (Poaceae): an example of insect pollination in a temperate grass. Am. J. Bot., 68: 389–394.

Cane, J. H. & J. A. Payne. 1988. Foraging ecology of the bee *Habropoda laboriosa* (Hymenoptera: Anthophoridae), an oligolege of blueberries (Ericaceae: *Vaccinium*) in the southeastern United States. Ann. Entomol. Soc. Am., 81: 419–427.

Chambers, V. H. 1945. British bees and wind-borne pollen. Nature, 155: 145.

Faegri, K. & L. van der Pijl. 1978. The principles of pollination ecology (3rd ed). Pergamon Press, New York.

Hauptli, H. & S. Jain. 1985. Genetic variation in outcrossing rate and correlated floral traits in a population of grain amaranth (*Amaranthus cruentus* L.). Genetica, 66:21–27.

Kaufman, C. S. 1979. Grain amaranth research: an approach to the development of a new crop. pp. 88–91. *In* Proc. second amaranth conf. Rodale Press, Emmaus, Pennsylvania.

Krombein, K. V., P. D. Hurd, Jr., D. R. Smith & B. D. Burks. 1979. Catalog of Hymenoptera in America north of Mexico. Vol. 2. Smithsonian Institution Press, Washington, D.C.

Michener, C. D. & C. W. Rettenmeyer. 1956. The ethology of *Andrena erythronii* with comparative data on other species (Hymenoptera, Andrenidae). Univ. Kansas Sci. Bull., 37: 645–684.

Munz, P. A. 1959. A California flora. University of California Press, Los Angeles.

Murphy, J. C. 1978. Pollination in the weedy amaranths. Abstr. Amer. Soc. Bot. Nat'l. Meet., 1978.

O'Neal, R. J. & G. D. Waller. 1984. On the pollen harvest by the honey bee (*Apis mellifera* L.) near Tucson, Arizona (1976–1981). Desert Plants, 6: 81–109.

Raw, A. 1974. Pollen preferences of three *Osmia* species. Oikos, 25: 54–60.

Sharma, M. 1970. An analysis of pollen loads of honeybees from Kangra, India. Grana, 10: 35–42.

Singh, H. B. 1961. Grain amaranthus, buckwheat and chenopods. Indian Counc. Agric. Res. Cereal Crop. Ser. I.

Wodehouse, R. P. 1971. Hayfever plants (2nd ed). Hafner Publishing Co., New York.

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